

What is Claimed is:

1. A device for inspecting solder connections between a component and a substrate or between two components or substrates, the device comprising:

5 an image receiving unit;

an image transmitting device, including a first end and a second end, the first end coupled to said image receiving unit;

10 a tip assembly removably coupled to said second end of said image transmitting device, said tip assembly further including a reflective device and an image receiving aperture, the tip assembly configured to transmit an image of said solder connections received by said reflective device, through said image transmitting device, to said image receiving unit; and

15 an illumination device including at least one light emitting aperture disposed adjacent said image receiving aperture, said light emitting aperture directed towards said solder connections to be inspected.

2. The device according to Claim 1, wherein the image receiving unit comprises a camera.

20 3. The device according to Claim 2, wherein the image transmitting device includes a generally cylindrical body having a plurality of lenses disposed therein.

25 4. The device according to Claim 1, wherein the image receiving unit includes a lens assembly coupled thereto, said lens assembly capable of increasing or decreasing magnification of said image to be received therein.

5. The device according to Claim 1, wherein said illumination device includes light source and a device for transmitting light from the light source to the light emitting aperture.

6. The device according to Claim 1, wherein said image receiving unit is disposed within a housing, said housing pivotally attached to a frame.

7. The device according to Claim 6, wherein a pivot point of rotation of said housing is the optical centerline of said mirror disposed within the tip assembly.

8. The device according to Claim 7, wherein said image transmitting device and said tip assembly are rotatable about an axis perpendicular to said substrate.

9. The device according to Claim 1, wherein said aperture filters the image to be transmitted prior to transmission of the image by the image transmitting device.

10. The device according to Claim 1, further including a display device coupled to said image receiving unit, the display device configured to display the solder connections to be inspected.

11. The device according to Claim 1, wherein said tip assembly further includes an illumination aperture disposed on either side of said image receiving aperture, wherein said illumination apertures direct light onto said solder connections to be inspected.

12. The device according to Claim 6, wherein said angle of pivot is between about 0 and about 5 degrees.

13. The device according to Claim 1, further including a back lighting assembly, the back lighting including an illumination source, a lens assembly, and a flexible arm coupled thereto.

14. The device according to Claim 5, wherein said device for transmitting light is a fiber optic device.

15. The device according to Claim 1, wherein the illumination device includes a light emitting diode disposed within said light emitting aperture and a power source coupled to said light emitting diode.

5           16. A device for optically inspecting soldered connections, the device comprising:

          a camera;

          a image transmitting device, including a generally circular cross-sectional profile first end and a second end and a bore extending therethrough, said first end coupled to the camera, and a at least one image transmitting lens disposed within the bore;

10           a tip assembly removably coupled to said second end of said transmitting device, said tip assembly further including a mirror and an image receiving aperture disposed adjacent to said mirror, said image receiving aperture and said mirror configured to receive and transmit an image the soldered connections to said camera through said image transmitting device; and

15           at least one illumination device, the illumination device comprising a light source, a device for transmitting light from the light source to a light transmitting aperture disposed within said tip assembly, the light transmitting aperture disposed adjacent to the image receiving aperture.

20           17. The device according to Claim 16, further including a magnifying lens disposed between the camera and the first end of the image transmitting device, the magnifying lens capable of magnifying the image of the soldered connection.

25           18. The device according to Claim 16, wherein said camera, image transmitting device, and tip assembly are rotatably and pivotally coupled to a movable arm, the movable arm coupled to a frame, the frame including a work surface configured to receive a circuit board to be inspected, the camera, image transmitting device and tip assembly being disposed generally perpendicular to said work surface.

19. The device according to Claim 18, wherein the camera, image transmitting device, and tip assembly are pivotable between about -10 and about 10 degrees relative to an axis extending perpendicular from said work surface.

5           20. The device according to Claim 19, wherein the camera, image transmitting device, and tip assembly may be rotated about said perpendicular axis.

10           21. The device according to Claim 20, further including a second illumination device, the second illumination device comprising a flexible shaft extending from said arm and a tip assembly, the tip assembly including a light transmitting aperture, wherein a light transmitting device is connected at one end to a light source and at the other end to the light transmitting aperture, the second illumination device configured to move independent of said camera, image transmitting device, and said tip assembly.

15           22. A method of inspecting soldered connections between an IC and a circuit board, the method comprising:

a disposing a circuit board having at least one IC soldered thereto on a work surface of an inspection device;

20           padding-left: 40px>aligning a tip of the inspection device with a row of soldered connections to be inspected;

illuminating the soldered connections to be inspected;

visually examining the soldered connections between the IC and the circuit board through an aperture disposed upon the tip of the inspection device;

25           padding-left: 40px>pivoting the tip assembly about an optical centerline of said reflective device to view the upper or lower solder connections;

rotating said tip assembly through about 180 degrees to view the sides of the soldered connections; and

visually inspecting the gaps formed between the soldered connections for optical clarity.

23. The method according to Claim 20, wherein the step of illuminating further comprises using a second illuminating device to illuminate the soldered connections from a direction opposite to the image receiving aperture.